

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Digitaria pauciflora* Hitchcock

COMMON NAME: Florida pineland crabgrass (= twospike fingergrass, twospike crabgrass, fewflowered fingergrass)

LEAD REGION: 4

INFORMATION CURRENT AS OF: May 2010

STATUS/ACTION:

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

90-day positive - FR date:

12-month warranted but precluded - FR date:

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): October 25, 1999

☐ Candidate removal: Former LP: ☐

☐ A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F - Range is no longer a U.S. territory.
- ___ I - Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M - Taxon mistakenly included in past notice of review.
- ___ N - Taxon may not meet the Act's definition of "species."
- ___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Poaceae (Gramineae), Grass Family

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Florida, U.S.A.

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Florida, Miami-Dade and Monroe Counties, U.S.A.

LAND OWNERSHIP: The current distribution of Florida pineland crabgrass is entirely within Long Pine Key of Everglades National Park (ENP) and Big Cypress National Preserve (BCNP), both managed by the National Park Service (NPS). Long Pine Key is approximately 19,839 acres (8,029 hectares [ha]), but the species does not occupy the entire area. The extent of area occupied at BCNP is unknown.

LEAD REGION CONTACT: Erin Rivenbark, 404-679-7379, erin_rivenbark@fws.gov

LEAD FIELD OFFICE CONTACT: South Florida Ecological Services Office, Paula Halupa, 772-562-3909 ext 257, paula_halupa@fws.gov

BIOLOGICAL INFORMATION:

Species Description: Bradley and Gann (1999, p. 49) provided the following description: "*D. pauciflora* is a rhizomatous perennial; sheath auricles ca. 1.5 mm [millimeters] long; sheaths hairy (becoming glabrous with age); ligule 1.5-2 mm long; leaf blades flexuous or twisted, spreading, 7-18 cm [centimeters] long, 1-2.2 mm wide, hairy on both surfaces (becoming glabrous with age); main axis of the inflorescence 10-80 mm long, primary branches 2-8, appressed or spreading from the main axis, ca. 0.3 mm wide; pedicels 2-3 mm long, 0.7-0.9 mm wide; spikelets 30-60 on a primary branch, lanceolate, 2.7-3 mm long, 0.7-0.9 mm wide; first glume often present; second glume the same length as spikelet, usually 7-nerved, glabrous, acuminate to acute; lemma of lower floret 7-nerved, acuminate to acute, glabrous; upper floret the same length as the lower floret; lemma of the upper floret becoming purple, acuminate to acute (Adapted from Webster and Hatch 1990)." While much of the reproductive biology and ecology has not been studied, Florida pineland crabgrass is known to reproduce sexually (Bradley and Gann 1999, p. 50), with fruit production in the fall (Wendelberger and Maschinski 2006, p. 3).

Taxonomy: The first documented collection of Florida pineland crabgrass was in 1903. The species was not documented in collections after 1936, until Charles E. Hilsenbeck rediscovered it in ENP in 1973 (Bradley and Gann 1999, p. 49). “The species was first described by Hitchcock in 1928 (see Webster and Hatch 1990) from specimens collected by Eaton from ‘Jenkins to Everglade’ in 1903 on a collecting trip with J.K. Small and J.J. Carter. Hitchcock in Small (1933) later placed it in the genus *Syntherisma*. Subsequent authors (Webster & Hatch 1990, Hitchcock 1950, Wunderlin 1998) have retained it in the genus *Digitaria*.” (Bradley and Gann 1999, p. 49). The only synonym is *Syntherisma pauciflora* (A.S. Hitchc.) A.S. Hitchc. (Integrated Taxonomic Information System [ITIS] 2010, p. 1).

The Integrated Taxonomic Information System (2010, p. 1) indicates that the taxonomic standing for *Digitaria pauciflora* A.S. Hitchcock is accepted. The online Atlas of Florida Vascular Plants (Wunderlin and Hansen 2008, p. 2), NatureServe (2009, p. 1), and The Florida Department of Agriculture and Consumer Services (FDACS) (Coile and Garland 2003, p. 19) all use the name *D. pauciflora*. We have carefully reviewed the available taxonomic information to reach the conclusion that the species is a valid taxon.

Habitat: Bradley and Gann (1999, p. 49) described the habitat as follows: “Plants occur most commonly along the ecotone between pine rockland and marl prairie, but do overlap somewhat into both of these ecosystems. The soil where it occurred at the Richmond Pine Rocklands has been classified as Biscayne marl, drained (USDA 1996). These habitats, particularly marl prairie, do flood for one to several months every year in the wet season.” Gann *et al.* (2006, p. 12) described the major habitat types for Florida pineland crabgrass at Long Pine Key to consist of pineland/prairie ecotones and prairies. Gann *et al.* (2006, p. 13) indicated that this species is associated with low elevation pinelands and pineland/marl prairie ecotones that flood each summer.

In a study examining the microhabitat characteristics in ENP, Fellows *et al.* (2002, p. 79) found that this species occurred 69 percent of the time in the ecotone community. It was found 49 percent of the time in mixed marl and rock substrate, 22 percent in marl, and 6 percent on rock. Dominant vegetation types included grasses (*Muhlenbergia capillaries* var. *filipes*, *Schizachyrium* spp.), sedges (*Cladium jamaicense*, *Rhynchospora* spp.), palms (*Serenoa repens*, *Sabal palmetto*), and mixed shrubs (*Chrysobalanus icaco*, *Conocarpus erectus*, and *Randia aculeata*) (Fellows *et al.* 2002, p. 79). It was most abundant with grasses (56 percent), then sedges (14 percent), mixed grasses and sedges (4 percent) and mixed palms and shrubs (2 percent) (Fellows *et al.* 2002, p. 79). Microhabitat was classified as being on mixed marl and rock soils, in the ecotone, most likely associated with grasses and in regions with solution holes (Fellows *et al.* 2002, p. 80).

Bradley and Gann (1999, p. 50) suggested that the hydroperiod requirements for the Florida pineland crabgrass be studied, since it may be limited in its distribution by hydroperiod. Periodic fires are extremely important in maintaining habitat; both marl prairie and pine rockland require fire to remove understory hardwoods and eliminate litter accumulations (Bradley and Gann 1999, p. 50). Pine rocklands in Miami-Dade County probably had a natural fire frequency of 3-7

years; marl prairies may have burned slightly more frequently (Bradley and Gann 1999, p. 50). In the absence of fire, tropical hardwoods quickly encroach.

Historical Range/Distribution: The historical distribution included central and southern Miami-Dade County along the Miami Rock Ridge, from the south Miami area (latitude 25° 42.5') to Long Pine Key (latitude 25° 20.5'), a range of approximately 42 miles (67.6 kilometers) (Bradley and Gann 1999, p. 49). An early collection is by J. K. Small and J. J. Carter (No. 916, NY), "in pinelands near the homestead road, between Cutler and Longview Camp, Florida, Nov. 9-12, 1903" (Bradley and Gann 1999, p. 49). The 1903 Eaton collections from "Jenkins to Everglades" were possibly from the same collecting trip.

Bradley and Gann (1999, p. 49) stated that after a few collections in the beginning of the century, this species seemed to disappear. After a 1936 collection, it was not found again until 1973 in ENP near Osteen Hammock on Long Pine Key (Avery 1983 as cited in Bradley and Gann 1999, p. 49). Since that time it had been documented many times in Long Pine Key. In 1995, a single plant was discovered in a small marl prairie on the grounds of the Luis Martinez U.S. Army Reserve Center in the Richmond Pine Rocklands in Miami-Dade County; however, this plant has since disappeared (Herndon 1998, p. 88; Bradley and Gann 1999, p. 49). Based on data from The Institute for Regional Conservation (IRC), this occurrence was last observed in 1997 and is considered extirpated due to decreased hydroperiod (K. Bradley, IRC, pers. comm. 2007; Gann *et al.* 2001-2008, p. 1). The Florida Natural Areas Inventory (FNAI) (2007, p. 191) noted that the species was extirpated from its historical range on the Miami Rock Ridge by drainage and development; however, additional survey work is needed to determine if the species could still be present on some remaining fragments (see Recommended Conservation Measures below). Prior to its discovery in BCNP in 2003, the range of this species was thought to have contracted by approximately 29 miles (46.7 kilometers) (Bradley and Gann 1999, p. 49).

Current Range/Distribution: Florida pineland crabgrass is currently known from the Long Pine Key area of ENP (Bradley and Gann 1999, p. 49, Gann *et al.* 2006, p. 3). Citing Avery, Bradley and Gann (1999, p. 49) indicated that this species occurred in an area "stretching from near the park entrance (just east of Long Pine Key), southwest to the Mahogany Hammock turnoff at the western end of Long Pine Key", an area of about 31 square miles (8,000 ha). Prior to research by Gann *et al.* (2006, p. 7), this species was known from the following locations within Long Pine Key: Hole-in-the Donut, Pine Blocks A, C, D, H. Follow-up surveys of historical locations yielded two additional extant occurrences of this species in the Hole-in-the-Donut (Gann *et al.* 2006, p. 8). In addition, Jimi Sadle, botanist at ENP, located the species at Pine Blocks SW2, B, and F2 (J. Sadle, NPS, pers. comm. 2010). Gann *et al.* (2006, p. 9) also expect to find new occurrences of Florida pineland crabgrass within ENP as work continues to establish the limits of this species' habitat requirements. Florida pineland crabgrass appears to have a much wider range than previously thought (Gann *et al.* 2006, p. 9).

In 2003, Keith Bradley (pers. comm. 2005a) discovered this species south of Loop Road in BCNP in Monroe County. This finding is a significant discovery, since it is the first occurrence of this narrow endemic documented outside of the Miami Rock Ridge / Everglades area (FNAI 2007, p. 191). Prior to this discovery, the only extant population was on Long Pine Key (FNAI

2007, p. 191). IRC and Fairchild Tropical Botanic Garden (FTBG) have initiated surveys of the general area around Gum Slough, south of Loop Road (K. Bradley, pers. comm. 2007). Funding became available for a full survey last year, and a full survey within BCNP is planned to begin in May 2010 (see Conservation Measures Planned or Implemented).

Additional surveys are needed at the Luis C. Martinez U.S. Army Reserve Station in the Richmond Pine Rocklands to confirm if the species has been extirpated (Gann *et al.* 2001-2008, p. 1) and if suitable habitat remains. Three other indefinite occurrences in Miami-Dade County should be investigated: (1) a site between Cutler and Longview Camp (last observed in 1903); (2) Jenkins Homestead (date unspecified); and, (3) South Miami (last observed in 1939) (K. Bradley, pers. comm. 2007). It is possible that these sites contain plants and / or suitable habitat. In short, there is some potential for the species to still occur on remaining pine rockland fragments within Miami-Dade County.

The species was not found during a two-year project intended to survey and map rare and exotic plants along Florida Department of Transportation (FDOT) right-of-ways within Miami-Dade and Monroe counties (Gordon *et al.* 2007, p. 1, 38).

Population Estimates/Status: Bradley and Gann (1999, p. 50) estimated the Long Pine Key occurrence to have approximately 1,001 to 10,000 individuals. The most recent information indicates that the baseline abundance estimate for Florida pineland crabgrass at Long Pine Key based on a log₁₀ abundance estimate is 1,000-10,000 (Gann *et al.* 2006, p. 11). Gann *et al.* (2006, p. 11) found 13 occurrences of this species and recorded it at 105 stations. Joyce Maschinski (FTBG, pers. comm. 2007) characterized the populations within ENP as abundant; however, no additional population estimates are available.

The population within BCNP is estimated at >10,000 plants (K. Bradley, pers. comm. 2007). Following up on the discovery of Florida pineland crabgrass in BCNP in 2003, FTBG and IRC conducted preliminary surveys in April 2003 and found approximately 200 plants (Wright 2003, p. 141). In May 2003, FTBG observed nine clusters, with the largest cluster having an estimated 500-600 plants (Wright 2003, p. 141). Based upon initial survey work, Keith Bradley (pers. comm. 2005a) had characterized the population to be spotty, but in places quite abundant. In 2005, Bradley (pers. comm. 2005a) indicated that there were a few thousand plants in the vicinity of Gum Slough and through Lostman's Pines, but they have not been able to conduct a full survey in the area to determine distribution and size. A full survey within BCNP is planned to begin in May 2010 (see Conservation Measures Planned or Implemented). Until this study is complete, the most accurate rangewide estimate is 1,000-10,000 individuals at Long Pine Key (Gann *et al.* 2006, p. 11) and >10,000 individuals within BCNP (K. Bradley, pers. comm. 2007).

The rounded global status of Florida pineland crabgrass is considered to be G1, critically imperiled (FNAI 2010, p. 1, NatureServe 2009, p. 1). NatureServe (2009, p. 1) cited reasons for this ranking due to only one occurrence at one site in ENP in a restricted range, intense development pressure, and threats within ENP including, plans for hydrologic restoration, changes in fire management, and establishment of invasive non-native plant species that change the frequency and intensity of fires in this species' habitat. Gann *et al.* (2001-2008, p. 1)

indicates that its status is critically imperiled. This species is listed as endangered by the State of Florida.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Habitat loss continues to occur in this species' historical range and most remaining suitable habitat has been negatively altered by human activity. Pine rocklands within Miami-Dade County have largely been destroyed by residential, commercial, and urban development and agriculture. Pine rocklands in the county (including patches of marl prairie) have been reduced to about 11 percent of their former extent (Kernan and Bradley 1996, p. 2). Of the estimated historical extent of 182,780 acres (74,000 ha), only 20,106 acres (8,140 ha) of pine rocklands remained in 1996. Outside of ENP, only about one percent of the Miami Pine Rock Ridge pinelands remain and much of what is left is in small remaining blocks isolated from other natural areas (Herndon 1998, p. 1).

Florida pineland crabgrass habitat at Long Pine Key in ENP (e.g., pineland / prairie ecotones and prairies [Gann *et al.* 2006, p. 12]) and BCNP are, for the most part, protected. The largest and only known populations are, therefore, essentially protected from habitat loss due to development or agriculture. Effects from hydrological changes and other natural and anthropogenic factors, however, may still affect this species (see Factor E).

There is some potential for the species to still occur on remaining pine rockland fragments. Miami-Dade County has developed a network of small public conservation lands and has encouraged conservation of natural vegetation on private land. However, on-going urban development places indefinite occurrences and suitable habitat at-risk on private or non-conservation lands, potentially affecting the species (if still present) and diminishing the likelihood for reintroduction or recolonization. For example, it is possible that the species and suitable habitat exists at three other sites in Miami-Dade County (Cutler and Longview Camp, Jenkins Homestead, and South Miami). In addition, the species was last observed in Miami-Dade outside of ENP at the Luis Martinez U.S. Army Reserve Station in 1997 (K. Bradley, pers. comm. 2007). Gann *et al.* (2002, p. 247) cited habitat destruction at this location as a major threat and suggested the transfer of a 144 acre (58.3 ha) surplus parcel at this station to a conservation agency. Bradley (pers. comm. 2007) cited decreased hydroperiod as the cause for the apparent extirpation; this site should be assessed for possible presence and / or suitability for reintroduction. . Increases in human population and development pressures are likely to make reintroduction or recolonization into former habitats difficult or unfeasible. Fortunately, the two remaining populations are located on public conservation lands, which should remain insulated from this threat. However, continued development is likely to prevent or limit recolonization and reintroduction outside of protected areas.

Climatic changes and sea level rise are major threats to south Florida, including this species and its habitat. The Intergovernmental Panel on Climate Change (IPCC) reports that the warming of the world's climate system is unequivocal based on documented increases in

global average air and ocean temperatures, unprecedented melting of snow and ice, and rising average sea level (IPCC 2007, p. 2; 2008, p. 15). Sea-level rise is the largest climate-driven challenge to low-lying coastal areas and refuges in the sub-tropical ecoregion of southern Florida (U.S. Climate Change Science Program [CCSP] 2008, p. 5-31, 5-32). The long-term record at Key West shows that sea level rose on average 0.088 inches (0.224 cm) annually between 1913 and 2006 (National Oceanographic and Atmospheric Administration [NOAA] 2008, p. 1). This equates to approximately 8.76 inches (22.3 cm) over the last 100 years (NOAA 2008, p. 1).

IPCC (2008, p. 28) emphasized it is very likely that the average rate of sea-level rise during the 21st century will exceed that from 1961 to 2003 (i.e., 0.071 inches [0.18 cm] per year), although it was projected to have substantial geographical variability. Partial loss of the Greenland and/or Antarctic ice sheets could result in many feet (several meters) of sea-level rise, major changes in coastlines, and inundation of low-lying areas (IPCC 2008, p. 28-29). Low lying islands and river deltas will incur the largest impacts (IPCC 2008, p. 28-29). Because dynamic ice flow processes in ice sheets are poorly understood, timeframes are not known; however, modeling indicates that “more rapid sea-level rise on century timescales cannot be excluded” (IPCC 2008, p. 29). According to CCSP (2008, p. 5-31), much of low-lying, coastal south Florida “will be underwater or inundated with salt water in the coming century.”

IPCC (2008, p. 3, 103) concluded that “climate change is likely to increase the occurrence of saltwater intrusion into coastal aquifers as sea level rises” and that “sea-level rise is projected to extend areas of salinisation of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas.” From the 1930s to 1950s, increased salinity of coastal waters contributed to the decline of cabbage palm forests in southwest Florida (Williams *et al.* 1999, p. 2056-2059), expansion of mangroves into adjacent marshes in the Everglades (Ross *et al.* 2000, p. 9, 12-13), and loss of pine rockland in the Keys (Ross *et al.* 1994, p. 144, 151-155). Hydrology has a strong influence on plant distribution in these and other coastal areas (IPCC 2008, p. 57). Such communities typically grade from salt to brackish to freshwater species. Human developments will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; CCSP 2008, p. 7-6). Loss of low-lying habitats, including pinelands and pineland / marl prairie ecotones where this species occurs, is expected.

The Science and Technology Committee of the Miami-Dade County Climate Change Task Force (MDCCCTF) (2008, p. 1) recognized that significant sea level rise is a very real threat to the near future for Miami-Dade County. In a January 2008 statement, the MDCCCTF (2008, p. 2-3) warned that sea-level is expected to rise 3-5 feet (0.9 – 1.5 m) within this century. With a 3-4 foot (0.9 – 1.2 m) rise in sea level (above baseline) Miami-Dade County: “Spring high tides would be at about + 6 to 7 feet; freshwater resources would be gone; the Everglades would be inundated on the west side of Miami-Dade County; the barrier islands would be largely inundated; storm surges would be devastating; landfill sites would be exposed to erosion contaminating marine and coastal environments. Freshwater and coastal mangrove wetlands will not keep up with or offset sea level rises of two feet per century or

greater. With a five foot rise (spring tides at nearly +8 feet), Miami-Dade County will be extremely diminished.” (MDCCCTF 2008, p. 2-3).

In summary, known occurrences in ENP and BCNP are insulated from the threat of habitat loss due to development. However, any unknown plants, indefinite occurrences, and suitable habitat remaining on private or non-conservation land are at-risk. Overall, the threat level of habitat loss from development is moderate. Known occurrences are protected, but unknown plants, indefinite occurrences, and potentially suitable habitat remain threatened by continuing development. Continued development of suitable habitat is likely to prevent or limit reintroduction or recolonization into the species’ historic range. All occurrences are in low-lying areas and will be affected by climate change and rising sea level. Overall threat level of habitat loss from sea-level rise is currently low, but expected to become severe in the future.

- B. Overutilization for commercial, recreational, scientific, or educational purposes. None known.
- C. Disease or predation. None known.
- D. The inadequacy of existing regulatory mechanisms. FDACS designated *Digitaria pauciflora* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State’s Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of listed plants, conservation does not occur. Where this species occurs on public conservation lands, existing regulatory mechanisms of those management agencies may be considered adequate and not a threat. However, any unknown plants, indefinite occurrences, and suitable habitat remaining on private and non-conservation lands are at-risk, potentially affecting the species (if still present) and diminishing the likelihood for recolonization or reintroduction. Existing regulatory mechanisms do not provide protection for State-listed plants or suitable habitat on private lands.
- E. Other natural or manmade factors affecting its continued existence. Fire maintains the pine rockland community. Under natural conditions, lightning fires typically occurred at 3 to 7-year intervals, or more frequently in marl prairies. With fire suppression, hardwoods eventually invade pine rocklands and shade out Florida pineland crabgrass (Bradley and Gann 1999, p. 50). Fire suppression outside of ENP has reduced the size of the areas that do burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities are becoming tropical hardwood hammocks. While application of prescribed fire is difficult in the urban pine rockland fragments in Miami-Dade County, it is somewhat easier to apply on larger public conservation lands.

Prescribed fire is actively being used at ENP and now appears to be effective in maintaining populations of Florida pineland crabgrass at this location (J. Sadle, pers. comm. 2010). In

1998, Herndon (1998, p. 91) had reported a sharp decline in the number of plants in one ENP location, which he attributed to prescribed fire followed by flooding caused by Tropical Storm Dennis in 1981. At BCNP, the degree to which fire is currently a factor is not known, as the extent of the species' occurrence and habitat has not yet been determined. FNAI (2007 p. 190) had suggested applying regular prescribed fire for this element occurrence in 2007. This implied, at least, that Florida pineland crabgrass within BCNP may need prescribed fire on a more regular basis than is currently occurring. The frequency at which the prairies supporting this species within BCNP burn should be further investigated (J. Sadle, pers. comm. 2010). At this time, fire suppression and lack of prescribed fire is a threat, though it may not be as much of a threat as previously believed at some sites.

Invasive plants have significantly affected pine rocklands. At least 277 exotic plants have invaded pine rocklands throughout south Florida (Service 1999, p. 3-175). The most problematic exotic plants in pine rocklands are Brazilian pepper (*Schinus terebinthifolius*) and Burmese reed (*Neyraudia reynaudiana*) (Bradley and Gann 1999, p. 50). Brazilian pepper is also a threat to marl prairies (Bradley and Gann 1999, p. 50). Bradley and Gann (1999, p. 50) stated that the Florida pineland crabgrass in ENP is threatened by exotic plants. In their study of Long Pine Key, Gann *et al.* (2006, p. 17) found that four species of exotic nonnative plants have been found growing in association with rare plants: shoebutton (*Ardisia elliptica*), centipede grass (*Eremochloa ophiuroides*), monk orchid (*Oeceoclades maculata*), and Brazilian pepper. Of these, only Brazilian pepper has been observed in the vicinity of Florida pineland crabgrass (J. Sadle, pers. comm. 2010). In 2008, an isolated patch of 10 individuals of Australian pine (*Casuarina equisetifolia*) were treated in Long Pine Key, Pine Block D. Florida pineland crabgrass either resprouted or recruited to this location after the Australian pine was killed (J. Sadle, pers. comm. 2010).

Both Long Pine Key and BCNP are susceptible to invasive exotic plants such as Burmese reed and Old World climbing fern (*Lygodium microphyllum*), which has spread southward into parts of ENP (Ferriter 2001, p. 7, Gann *et al.* 2002, p. 37-38, Ferriter 2003, p. 1). Old World climbing fern is capable of smothering vegetation and is spreading rapidly in Florida (Ferriter 2001, p. 1, Volin *et al.* 2003, p. 1). In 2000, ENP staff discovered new, but widespread populations of the fern in the western coast of ENP (Ferriter 2001, p. 7). The populations had not been detected in 1999 and are particularly alarming due to their remote location and seemingly rapid establishment and spread (Ferriter 2001, p. 7). Similarly, Volin *et al.* (2003, p. 1) suggested an alarming increase in establishment of this fern across south Florida, particularly in the cypress-dominated wetlands of Big Cypress swamp. Old World climbing fern has the potential to become uncontrollable, except through biological control. In addition, the former agricultural lands of the Hole-in-the-Donut adjacent to Long Pine Key are infested by invasive plants such as Brazilian pepper and common guava (*Psidium guajava*) and are a potential source of seeds of these invasive species. NPS is restoring those former agricultural lands, but invasive exotic plants will continue to be a threat even after this restoration work is completed (J. Sadle, pers. comm. 2010).

Recreational use of off-road vehicles (ORV) is a threat to Florida pineland crabgrass occurrences within BCNP (K. Bradley, pers. comm., 2005b). While recreational users are

mandated to operate on designated trails in this management unit, illegal ORV use can occur. The degree to which illegal ORV use is affecting Florida pineland crabgrass within BCNP is not known, since the extent of the species' occurrence and habitat within BCNP has not yet been determined. It is important to determine the extent to which ORVs may be affecting the species and habitat at this site, since it is one of only two sites where the species is known to exist. Any negative impacts should be avoided or minimized to the maximum extent possible.

Hydrology is a key ecosystem component that affects rare plant distributions and their viability (Gann *et al.* 2006, p. 4). Historically, sheet flow from Shark River Slough and Taylor Slough did not reach the upland portions of Long Pine Key, but during the wet season increased surface water flow in sloughs generated a rise in ground water across the region (Gann *et al.* 2006, p. 4). As artificial drainage became more widespread, however, regional groundwater supplies declined. Historical patterns of water flow through Long Pine Key are further confounded by road construction (Gann *et al.* 2006, p. 4). Water flow through Long Pine Key was originally concentrated in marl prairies, traversing in a north-south direction; however, construction of the main ENP road dissected Long Pine Key in an east-west direction, thereby impeding sheet flow across this area (Gann *et al.* 2006, p. 4). Water was either impounded to the north of the main ENP road or diverted around the southern portion of Long Pine Key through Taylor Slough and Shark River Slough (Gann *et al.* 2006, p. 4). Research Road may similarly affect the water supply of the southern portions of Long Pine Key (Gann *et al.* 2006, p. 4).

Changes to regional water management intended to restore the Everglades could negatively affect the pinelands of Long Pine Key (Herndon 1998, p. 2, Gann *et al.* 2002, p. 247, Gann *et al.* 2006, p. 5). Gann *et al.* (2006, p. 5) stated that if hydrological restoration is successful, ground water levels will presumably be raised, wet season flows will return to marl prairies and fire intensities will decrease, and growing conditions for rare pineland and hammock plants will improve. Alternatively, implementation of the Comprehensive Everglades Restoration Plan may also lead to further impoundment of water north of the main park road, possible flooding of rare plant populations, and a failure to provide relief to habitats on Long Pine Key that are compartmentalized (by the main ENP road and Research Road) and have been impacted from long-term drainage (Gann *et al.* 2006, p. 5). At this time, it is not known whether the proposed restoration and associated hydrological modifications will have a positive or negative impact on rare species within ENP, including Florida pineland crabgrass (Gann *et al.* 2006, p. 5). However, since the ENP is only one of two locations known to support this species, it will be important to determine potential impacts and monitor the species and its habitat.

Given the species' narrow range and limited number of occurrences, Florida pineland crabgrass is vulnerable to catastrophic events and natural disturbances, such as hurricanes. Hurricanes have impacted Miami-Dade County in the past (e.g., Hurricane Andrew). Three hurricanes made landfall in south Florida in 2005 (Katrina, Rita, and Wilma). According to NOAA, Miami-Dade County, the Keys, and western Cuba are the most storm-prone areas in the Caribbean, so this threat is expected to continue. Increased sea surface temperatures in

association with climate change could increase the frequency, severity, and duration of hurricanes. The threat of hurricanes or other catastrophic events and natural disturbances is considered to be high due to the species' restricted range and few occurrences.

In summary, Florida pineland crabgrass is threatened by a wide array of natural and manmade factors. Fire suppression, invasive exotic plants, ORV use, alterations in hydrology, and catastrophic events all pose a threat to this species. Prescribed fire and exotic species control efforts by the NPS will likely be beneficial to this pine rockland / marl prairie dependent species. Since the population size and distribution at BCNP is unknown, the full impact of ORV use is uncertain. The response of Florida pineland crabgrass to hydrologic changes associated with Everglades restoration will remain unknown until these projects are fully implemented. The threat from tropical weather events is expected to continue and will likely increase. Given its limited distribution and low number of known occurrences remaining, any one of these factors could have a significant impact on the continued existence of Florida pineland crabgrass. Since few occurrences remain in a restricted range, the overall magnitude of threats is considered high.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Public lands with Florida pineland crabgrass are managed by NPS. ENP and BCNP are conservation areas whose pinelands are managed to maintain the natural vegetation. The NPS has worked to control exotic plants on its south Florida lands.

Everglades restoration will consider the protection of the uplands of Long Pine Key as water flow into the surrounding Everglades wetlands is restored. Through the Critical Ecosystems Study Initiative, a 5-year study was funded to survey and map the 30 rare species identified in Gann *et al.* (2002), establish a long-term monitoring program to evaluate population responses of these species to Everglades restoration, and augment or reintroduce populations of select species, if warranted (Gann *et al.* 2006, p. 2). Data from this study indicate that the Florida pineland crabgrass population at Long Pine Key is abundant (Gann *et al.* 2006, p. 13).

In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program, which reduces taxes for private landowners of pine rocklands and tropical hardwood hammocks who agree to not develop their property and manage it for a period of ten years (Service 1999, p. 3-177). Miami-Dade County also purchases natural forest communities (NFC), including tropical hammocks and pine rocklands. These programs can benefit Florida pineland crabgrass by maintaining habitat in private or public ownership.

The Miami-Dade Forest Resources Program has regulatory authority over pine rocklands and tropical hardwood hammocks and is charged with enforcing regulations that provide partial protection on the Miami Rock Ridge (Service 1999, p. 3-177). This includes authority over all NFCs in the county, including county- and city-owned parcels (Service 1999, p. 3-177). This program can benefit Florida pineland crabgrass by providing some protections to habitat on private and city- and county-owned parcels.

In cooperation with the Service and IRC, Miami-Dade County funded a project to map the

existing NFCs and inventory rare and sensitive plants species. This project has been completed; Florida pineland crabgrass was not found.

In 2005, the Service funded IRC through the Private Stewardship Grant Program to facilitate restoration and management of privately-owned pine rockland habitats in Miami-Dade County. Restoration efforts include exotic plant control, light debris removal, hardwood management, and reintroduction of pines. Management plans include recommendations for prescribed burning, debris cleanup, exotic animal control, and hydrological restoration. This project was completed in 2006. Although Florida pineland crabgrass did not occur on any pine rocklands that were restored, it could, potentially, be reintroduced into one of its historic locations in the future, if suitable habitat exists and if threats can be adequately removed.

In 2003, FTBG created a conservation action plan for Florida pineland crabgrass that included conducting research on the habitat requirements, plant associates, and response to hydroperiod shifts and fire, to assist in management recommendations and accurate evaluation of site suitability for possible reintroduction (Fellows *et al.* 2003, p. 146). More recently, FTBG has collected seeds from 248 maternal lines from three of the five locations at ENP (Wendelberger and Maschinski 2006, p. 3). Kristie Wendelberger (FTBG) has collected thousands of seeds of this species for storage at the National Center for Genetic Resources Preservation (J. Maschinski, pers. comm. 2007).

In 2009, the South Florida Ecological Services Office received funding from the Service's Southeast Regional Office for a project proposal to determine the population size, extent of habitat, and possible threats to Florida pineland crabgrass and Everglades bully (*Sideroxylon reclinatum* ssp. *austrorfloridense*) within BCNP. With this funding, the IRC will survey a 13,000 hectare (32,124 acre) area. It is possible that the extent of habitat and population size within BCNP for both species is significant, and larger than previously thought. Determining the population size, extent of habitat, and threats is fundamental to understanding these species' status and conservation needs. Once the extent of habitat is determined and populations are assessed/mapped, the Service plans to work with the NPS and IRC to remove or reduce threats (e.g., fire suppression, changes to hydrology) through management.

The FDOT collaborated on and funded a study of the approximately 650 miles of FDOT roadway in Miami-Dade and Monroe counties (District 6) (Gordon *et al.* 2007, p. 1, 3). The study was conducted by The University of Florida, in collaboration with IRC and the FNAI to survey and map exotic and rare native plants along FDOT right-of-ways within Miami-Dade and Monroe counties and to create a database that can be updated to reflect future activities and conditions (Gordon *et al.* 2007, p. 1, 3). Although this species was not found during this study, this effort created a database that can be updated in the future which may be helpful in managing roadside areas (Gordon *et al.* 2007, p. 1, 3), should the species re-establish itself in these areas.

SUMMARY OF THREATS

Pine rocklands in Miami-Dade County have largely been destroyed by residential, commercial, and urban development and agriculture. Most remaining suitable habitat has been negatively altered by human activity and this species has been extirpated from its historical range on the

Miami Rock Ridge by drainage and development. Two large occurrences of the Florida pineland crabgrass remain, located within ENP and BCNP. While privately owned pine rocklands and marl prairies are at risk of development, occurrences and habitat on Federal lands are protected from this threat. Most occurrences are in low-lying areas and will be affected by climate change and rising sea level over the long term. The threat from climate change and sea level rise is currently low, but expected to become severe in the future. Florida pineland crabgrass is threatened by habitat loss and degradation due to fire suppression, the difficulty of applying prescribed fire to pine rocklands, and invasive exotic plants. However, since the only known occurrences of this species are on lands managed by NPS, the threats of fire suppression and exotics are somewhat reduced. The NPS actively manages its pine rocklands and appears to have the resources to implement prescribed fire and exotic plant control at this time; however, threats from invasive exotic plants remain. The presence of Old World climbing fern within ENP and BCNP is of particular concern due to its ability to rapidly spread. In BCNP plants may be threatened by ORV use. Hydrology has been altered within Long Pine Key due to artificial drainage, which lowered ground water, and construction of roads, which either impounded or diverted water. Regional water management intended to restore the Everglades could negatively affect the pinelands of Long Pine Key. Hydrologic restoration could improve conditions for pineland plants; however, components of Everglades restoration may also negatively affect species. At this time, it is not known whether the proposed restoration and associated hydrological modifications will have a positive or negative effect on Florida pineland crabgrass. This narrow endemic is vulnerable to catastrophic events and natural disturbances, such as hurricanes. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Survey BCNP to determine the extent of the population and its habitat.
- Continue monitoring at Long Pine Key (Gann *et al.* 2006, p. 2). It is important to determine effects (positive or negative) from Everglades restoration and other hydrologic manipulations and changes.
- Conduct conservation biology and horticulture studies (Gann *et al. et al.* 2002, p. 247).
- Consider continuation of *ex situ* conservation work.
- Continue controlling exotic plant species where the species is found (J. Sadle, pers. comm. 2008).
- Determine the frequency with which prairies within BCNP burn (J. Sadle, pers. comm. 2010), and work with partners to adjust accordingly.
- Conduct research on the habitat requirements, plant associates, and response to hydroperiod shifts and fire, to assist in management recommendations and accurate evaluation of site suitability for possible reintroduction (Fellows *et al. et al.* 2003, p. 146).
- Assess the potential impacts of ORV on occurrences within BCNP.
- Conduct surveys at the Luis C. Martinez U.S. Army Reserve Station in the Richmond Pine Rocklands (Gann *et al. et al.* 2001-2008, p. 1) and all sites with indefinite occurrences and potentially suitable habitat (K. Bradley, pers. comm. 2007). Evaluate

the feasibility of reintroduction if suitable habitat exists or can be restored.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5*
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: Only two occurrences are known to exist within a restricted range. Known occurrences face little risk from habitat loss to development since these occur within ENP and BCNP. There is some potential for the species to still occur on remaining pine rockland fragments within Miami-Dade County. Any unrecorded or indefinite occurrences and suitable habitat remaining on private or non-conservation lands are threatened by continued development, potentially affecting the species (if still present) and the likelihood of recolonization or reintroduction. Continued development of suitable habitat diminishes the potential for reintroduction into its historic range. Overall, the threat level of habitat loss from development is moderate. Known occurrences are protected, but unknown plants, indefinite occurrences, and potentially suitable habitat remain at-risk. All extant occurrences are in low-lying areas and will be affected by climate change and rising sea level. Overall threat level of habitat loss from sea-level rise is currently low, but expected to become severe in the future. Fire suppression, the difficulty of applying prescribed fire to pine rocklands, and threats from exotic plants are ongoing threats; however, efforts are underway to combat these threats to a certain extent. We consider these threats moderate. Hydrologic alteration in the past has impacted Long Pine Key. The effects of various Everglades restoration projects are unknown. Plants at ENP are abundant and occur in a wider range than previously thought. In BCNP plants are threatened by ORV use, the magnitude of which is unknown. The Florida pineland crabgrass is vulnerable to catastrophic events and natural disturbances, such as hurricanes. The threat of hurricanes or other catastrophic events and natural disturbances is considered to be high due to the species' restricted range and few occurrences. The likelihood of establishing a sizable population on

other lands is diminished due to continuing habitat loss. Given limited distribution and low number of occurrences, the overall magnitude of threats is considered to be high.

Imminence: Most remaining suitable habitat has been negatively altered by human activity and this species has been extirpated from its historical range on the Miami Rock Ridge by drainage and development. The two known occurrences of the Florida pineland crabgrass within ENP and BCNP are not threatened by habitat loss from development. However, any unknown or indefinite occurrences and suitable habitat remaining on private or non-conservation lands are currently at-risk since development is on-going in Miami-Dade County. Sea-level rise has resulted in the loss of pine rocklands. However, this is considered a long-term threat since we do not have evidence that it is currently affecting any population. Efforts are underway to combat threats from invasive exotic plants on Federal lands. Fire is necessary to maintain habitat for this species. ENP has an active fire program, but the use of fire at BCNP in relation to this plant is unknown at this time. Threats from fire suppression and difficulty in using prescribed fire are considered to be non-imminent. The degree to which illegal ORV use is affecting Florida pineland crabgrass within BCNP is not known, since the extent of the species' occurrence and habitat within BCNP has not yet been determined. Hydrologic alterations have impacted Long Pine Key in the past. Planned Everglades restoration and associated hydrologic changes will likely affect this species in the future. At this time, the extent of potential negative impacts (if any) is considered unknown and non-imminent. Overall, the majority of threats are considered non-imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Although the threats are considered high, known occurrences are located on Federal lands. To some extent, threats can be addressed by NPS.

DESCRIPTION OF MONITORING: Monitoring of this species is being actively conducted in ENP by IRC. IRC and FTBG have initiated surveys at the occurrence in BCNP. However, additional survey and monitoring work is needed in BCNP.

The Service completed a project with IRC and Miami-Dade County to map public and many private natural forest communities for the County's geographic information system. This project provided a list of plant species for each site. The project enables the County to manage information on pinelands and detect changes in their extent. While the Florida pineland crabgrass is not known to exist on these parcels, conservation of remaining fragments will help retain the potential for future reintroductions into the species' former habitat.

In 2003-2004, FTBG surveyed the distribution and collected GPS points of the new location in BCNP (Maschinski *et al.* 2004, p. 12). Results showed a larger population size than what was previously known and concluded that attention should focus on surveying for new populations, instead of performing ecological studies (Maschinski *et al.* 2004, p. 12).

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: The Service requested new information (observations, data, reports) regarding the status of this plant or any new information regarding threats to this species and its habitat from: FDACS, NPS, Service (National Wildlife Refuges), Florida Department of Environmental Protection, Miami-Dade County, Florida Fish and Wildlife Commission, FNAI, IRC, Historic Bok Sanctuary, The Nature Conservancy, FTBG, Archbold Biological Station, NatureServe, University of Central Florida, Florida International University, University of Florida, Princeton, members of the Rare Plant Task Force, botanists, and others. In total, the previous assessment was sent to approximately 200 individuals.

The State of Florida does not specifically list plants in its State Wildlife Action Plan.

Indicate which State(s) did not provide any information or comments: None

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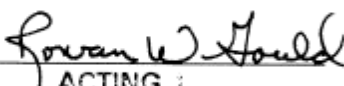
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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  June 15, 2010
for Regional Director, Fish and Wildlife Service Date

Concur: 
ACTING
Director, Fish and Wildlife Service Date: October 22, 2010

Do not concur: _____
Director, Fish and Wildlife Service Date _____

Director's Remarks:

Date of annual review: May 2, 2010
Conducted by: Paula Halupa, South Florida Ecological Services Office